

Surface Modification Branch Seminar

Carbon Megatubes, Functionalized Perfluoropolyethers, and Laser Processing of Metals

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Abstract

“The Synthesis, Characterization and Applications of Carbon Megatubes”

Extremely large carbon tubes, “carbon megatubes” some exceeding five microns in diameter, were produced with both laser and electric arc techniques using graphite, a transition metal catalyst and a reactive third-body gas. They are the first carbonaceous tubes large enough to observe using optical microscopy. We also report the synthesis of what we believe to be the first self-assembled branched nanotubes. X-ray photoelectron spectroscopy has been used to study elemental composition and the electronic transport properties of megatubes have also been probed. Their conductance has been shown to be higher than that of similarly tested multi-wall carbon nanotubes.

“Functionalized Perfluoropolyethers as Super Critical CO₂ Soluble Compounds”

Mono-functional and di-functional Polyethylene glycol esters were directly fluorinated to yield perfluoropolyethylene glycol acids. These were shown to be highly SC-CO₂ soluble compounds that exhibited desirable surfactant properties. In addition, these acids underwent further chemical modification to yield compounds with a wide variety of end functionalities. Thiol terminated products are being test for their utility to synthesize metal nanoparticles in SC-CO₂.

“Metal Atom Chemistry Revisited: The Use of a CO₂ Laser for Metal Vaporization”

It has been shown by Lagow and others that a wide variety of sigma bonded metal compounds can be created by co-condensing vaporized metal atoms with radicals created from a Rf glow discharge plasma. This method begins to fail when the metal does not have a sufficiently high vapor pressure to be volatilized with resistive heating. These refractory metals are also highly reflective in the infrared and visible region, which makes laser heating a challenging prospect. A method has been developed that harnesses the thermal power of a CO₂ laser to heat the metal target while at the same time disposes of the reflected light. This method has shown promise to create many refractory metal compounds that are not accessible with ordinary synthetic methods.

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